Fabrication of 2D Material Based NEMS Resonators

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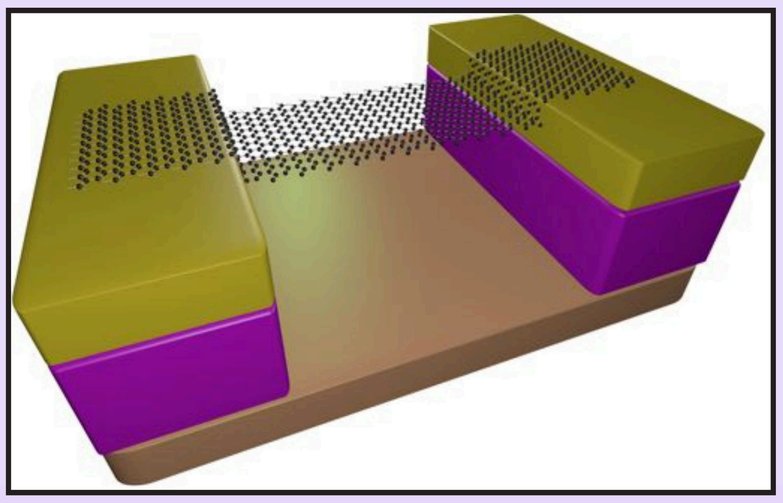
Abstract

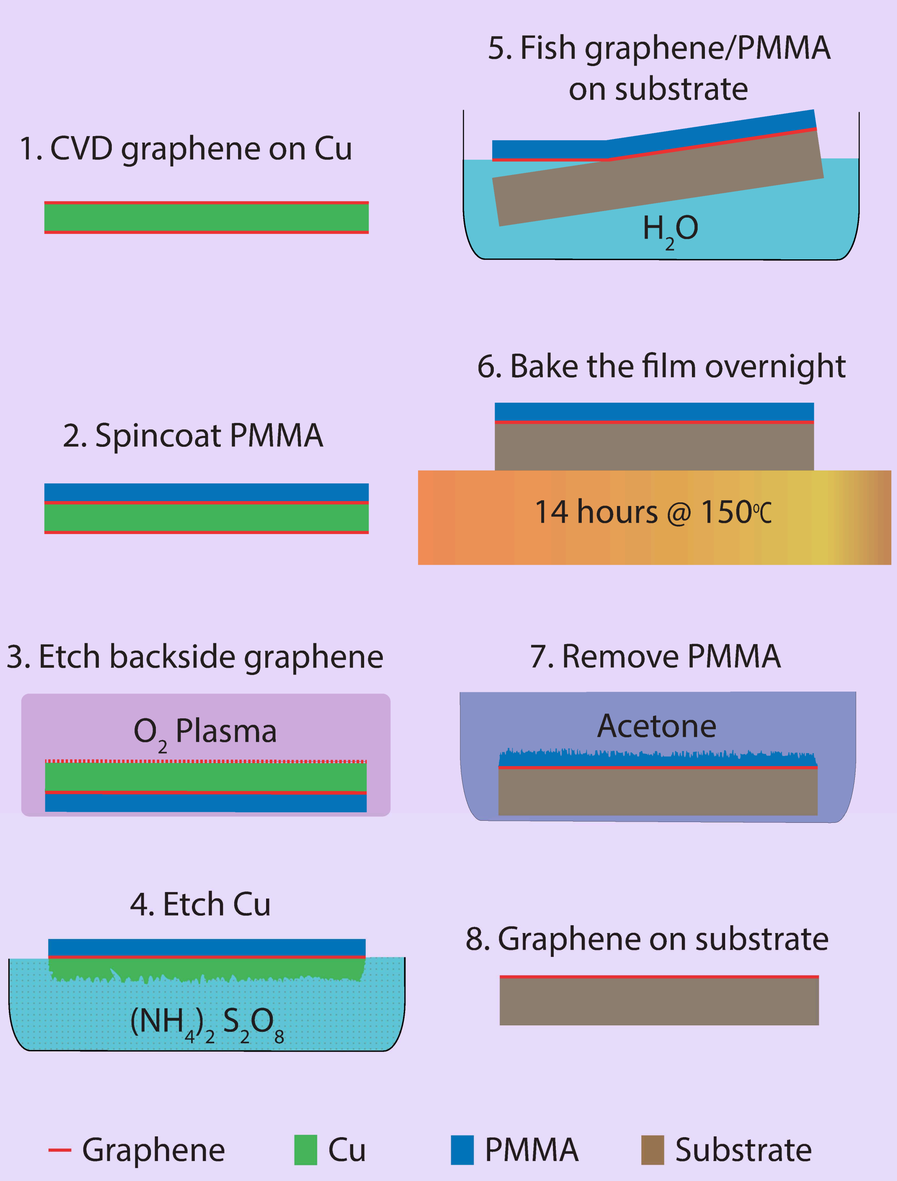
2D materials such as graphene [1], MoS_2 [2] and phosphorene [3] are promising candidates for resonating mechanical sensors due to excellent tunable electrical/-mechanical properties, low masses, and maximal surface to volume ratios.

Mechanical resonators based on supsended graphene have been realized.

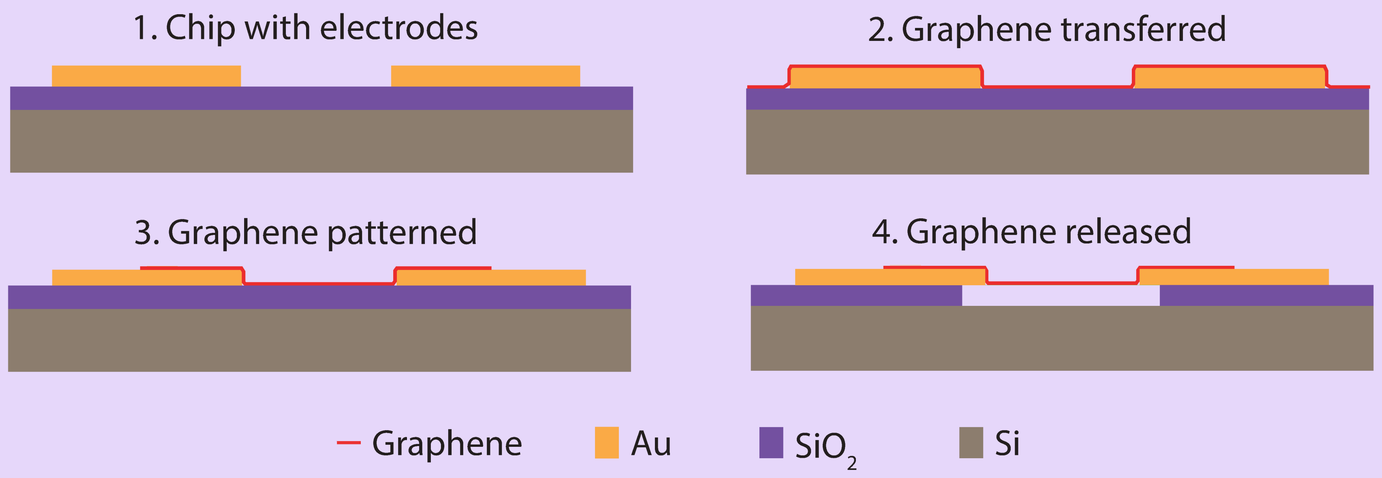
- CVD graphene wet-transferred onto 10x10 mm Si/SiO_2 chips with Au electrodes
- Graphene patterned in O_2 plasma with a resist mask
- Graphene is released by etching SiO_2 in BHF and critical point drying



Graphene Transfer



Device Fabrication and Results



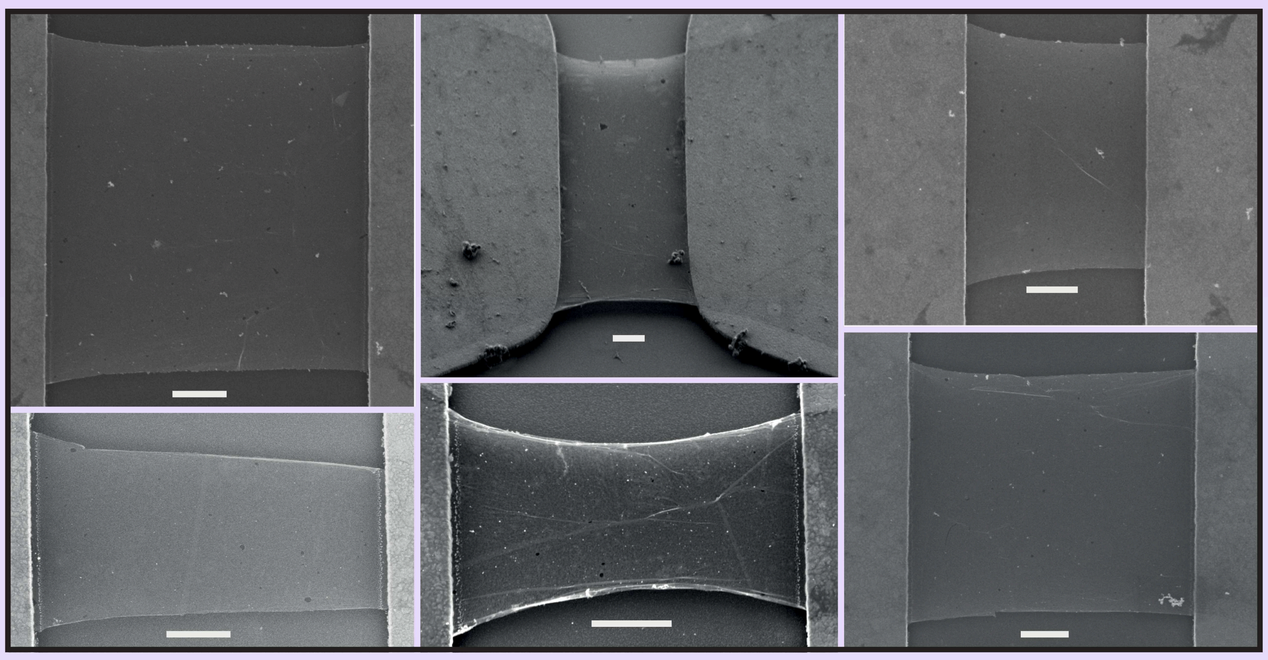


Fig. 1: SEM pictures of fabricated devices having different dimensions. Scale bar: 1 µm.

Measurements

Sheet Resistance Measurement with Tranmission Line Method

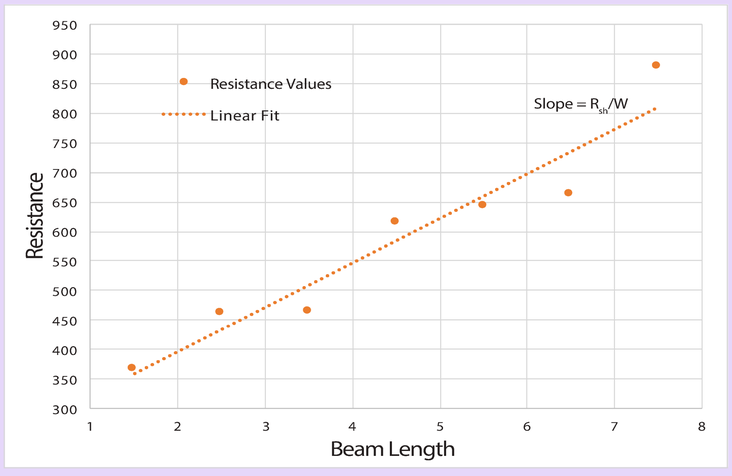


Fig. 2: Resistance vs. Gate voltage for graphene sheets of width 6.5 µm.

Field Effect Transistor Behavior

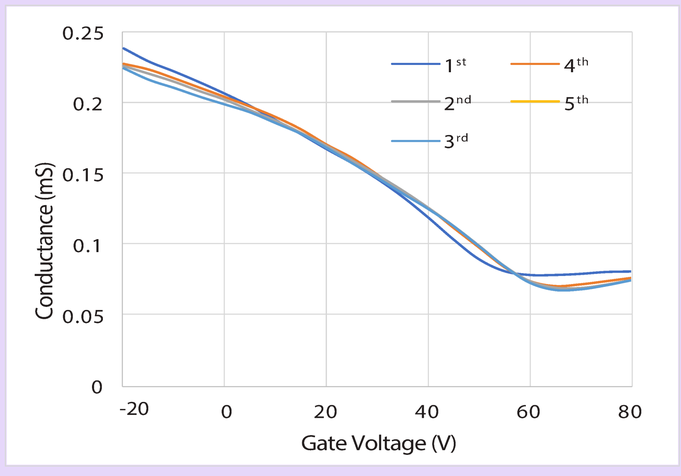


Fig. 3: Conductance vs. Gate Voltage profile of an unsuspended graphene sheet, for five consecutive measurements.

Conclusion

- Suspended graphene sheets 3-9 µm in width and 2-8 µm in length have been fabricated.
- Graphene's sheet resistance was measured to be 1500 Ohms/Sq and 500 Ohms/Sq for unsuspended and suspended graphene, respectively.
- Graphene's FET behavior was confirmed.
- The next step is to implement electrostatic transduction and operate the device at its mechanical resonant frequency.

References

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